VoLTE for Public Safety Broadband Networks

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Agenda

1. Voice Options for LTE Networks
2. IMS VoIP for LTE (VoLTE) - Overview and Architecture
3. LTE Network Considerations for Voice Services
LTE voice options: effect on subscriber services

- retain LTE bandwidth
- minimize call setup delay
- all-IP services: video, wideband audio
- roaming, interoperability

IMS-Based GSMA VoLTE is the approach embraced by global standards, industry associations, and operator community for voice on LTE
Comparing services and deployment factors

- Focus investment on creating the next gen service, not limited capability legacy infrastructure.
  - Commercial operators have embraced GSMA VoLTE (IMS VoIP) on a global scale
    - Some operators start with IMS
    - Many will transition from CSFB to IMS on the heels of the LTE data overlay
  - Public Safety Broadband networks have no legacy MSC Infrastructure to leverage
  - Public Safety networks should embrace a solution based on IMS VoIP for LTE
  - GSMA VoLTE offers 2 way, full duplex voice telephony services, also considered to enable mission critical communications by modern public safety communities (vs. just push to talk)

<table>
<thead>
<tr>
<th>Service and Deployment factors</th>
<th>IMS VoIP</th>
<th>CSFB</th>
<th>Custom Methods</th>
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<tbody>
<tr>
<td>Converged Service Control</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Flat all-IP benefits: subscriber services, OpEx</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3GPP Standards</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<td>Roaming, global interoperability</td>
<td></td>
<td></td>
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<td>Ecosystem of network and handset vendors</td>
<td></td>
<td></td>
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<tr>
<td>Avoid LTE network upgrade for Voice with LTE?</td>
<td>No</td>
<td>Minor</td>
<td>No</td>
</tr>
<tr>
<td>Avoid 2G/3G MSC network upgrade for Voice with LTE?</td>
<td>Yes (VoIP in LTE and 3G PS)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Avoid investment in interim method</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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IMS VoIP is the right solution for Public Safety voice telephony services, enabling nationwide PSBB interoperability as well as with commercial LTE networks.
GSMA VoLTE overview

- In LTE and 3G PS: Fully packet switched VoIP
- In 2G/3G CS, use SR-VCC and IMS Centralized Services

Services:
- IMS VoIP, SMS
- GSMA RCS (Rich Communication Suite)
- Voice blending
- Video telephony
- All-IP service

Retain LTE’s bandwidth during voice calls

Alcatel-Lucent Status:
Trials: today
Commercial: 1H 2011
SR-VCC: 2H 2011

Network:
- IMS, new or reuse
- SR-VCC for 2G/3G Circuit
- MME software, interface
- eUTRAN software, interface
- IMS client

IMS VoIP ensures global roaming and interoperability while retaining LTE’s high-bandwidth services
IMS Based VoLTE
Required Solution Enhancements

The approach:
 Provide voice to LTE UEs using IMS to provide the voice services

Key elements:
 IMS core with Telephony Application Server (TAS) to provide end-user services
 LTE E-UTRAN enhanced for VoIP delivery
 Service Centralization to provide a consistent service delivery across radio access technologies using IMS Centralized Services (ICS)
 Single Radio VCC to provide handover capabilities between different radio technologies
Voice via IMS
High Level Architecture

- **Simultaneous Voice and Data on LTE**
  - Handset has concurrent access to:
    1. Data services including internet access
    2. IMS Services including VoIP end-end calling
    3. IMS interworking towards legacy PSTN/PLMN networks
  - Offers all of the benefits of IMS including:
    - Multimedia services including video
    - Differentiated services even while roaming via home-network control

- **IMS Services outside of LTE coverage**
  - For service transparency, IMS Centralized Services (ICS) provides IMS services even when the handset is out of LTE coverage
  - In 3G handset has concurrent access to:
    1. Data Services including internet access
    2. IMS Services including circuit-mode transport of voice path
    3. Calls to/from the PSTN/PLMN legacy network as well as calls to VoIP end users in IMS
  - While on 2G network the handset has access to data services, but not concurrently with voice
VoIMS handover to legacy mobile network

- **PS handover**
  - **Approach**
    - Simple PS handover triggered by MME involving SGSN and S/PGW
  - **Service restrictions**
    - Full IMS services maintained during handover and remainder of call
    - PS voice bearer support required
    - Not recommended over GSM

- **Single Radio VCC**
  - **Approach**
    - SRVCC mechanism triggered by MME, involving MSC and SCC
  - **Service restrictions**
    - IMS services maintained during handover and remainder of call (depends on available ICS options)
    - Available over all mobile networks with SRVCC roaming agreements
Selected Network Functionality Required for Voice Services

- **eNB Foundations**
  - HARQ
  - Dedicated bearers - up to 8 per UE

- **Service Continuity**
  - SR-VCC
  - ISIM support for UE
  - QCI dependent triggers (set HO triggers for VoIP only traffic)

- **eNB Scheduler**
  - Semi persistent scheduling for HARQ (SPS)
  - QOS aware scheduler
  - Delay-based scheduler
  - Proportional Fair Scheduler
  - Frequency Selective Scheduler UL/DL
  - Service Aware Buffer Est. (SABE)

- **Other eNB Optimizations**
  - Robust Header Compression (RoHC)
  - TTI bundling
  - Inter-Carrier Interference (ICI) coordination over X2
  - Dynamic Admission Control (AC)
  - GBR with differentiated admission control (AC)
  - QOS aware link adaption (codec rate adaption)
  - QCI aware load balancing
  - EPS bearer modification
  - Discontinuous Reception (DRX), VoIP optimized DRX (battery life)

*Ingredients of a high quality, high capacity Mobile Voice over IP offering! Optimizations for voice traffic patterns and wireless codecs balance quality and capacity*
A Glance at Performance: VoIP Capacity

**VoIP Capacity in 5 MHz**

- **Interference limited:** 241 Erlangs
- **Coverage limited:** 123 Erlangs

3GPP Capacity Estimates:
- AMR 12.2 codec

**Source:** Alcatel-Lucent simulation results
Regulatory Considerations and Features

- Emergency Calls including E911 Location
  - Geo-location basics - Assisted GPS, ECID, OTDOA
  - Control plane location based services
  - User plane location based services

- CALEA support for VoIP
  - Support required in IMS for lawful intercept of voice calls